```
|-----------------------------------------------------|
|                    nd_vector                        |
|-----------------------------------------------------|
| - vector<double> x[]                                |
|-----------------------------------------------------|
| + nd_vector(unsigned)                               |   // constructor: initialize x(unsigned, 0.)
| + nd_vector(std::initializer_list<double>)          |   // constructor: initialize x[] like a list
| + size() const                                      |   // (unsigned) return size
| + read(std::ifstream&)                              |   // (void) read from input
| + print() const                                     |   // (void) print every element
| + operator[](unsigned)                              |   // (reference) return elem[unsigned]
| + operator[](unsigned) const                        |   // (value) return elem[unsigned]
| + data()                                            |   // (pointer) return ptr. to 1st elem
| + data() const                                      |   // (const_pointer) return cptr. to 1st elem
|-----------------------------------------------------|
```

```
|-----------------------------------------------------|
|                  dense_matrix                       |
|-----------------------------------------------------|
| - unsigned m_rows                                   |
| - unsigned m_columns                                |
| - vector<double> m_data                             |
|-----------------------------------------------------|
| - sub2ind(unsigned, unsigned) const                 |   // (unsigned) return the index of (i,j) in m_data
| + dense_matrix()                                    |   // constructor: default
| + dense_matrix(unsigned, unsigned, double=0.)       |   // constructor: (#rows x #columns) initialized with double
| + dense_matrix(std::istream&)                       |   // constructor: from input
| + read(std::istream&)                               |   // (void) read from input
| + swap(dense_matrix&)                               |   // (void) swap two dense_matrix
| + operator() (unsigned, unsigned)                   |   // (reference) return elem[i,j]
| + operator() (unsigned, unsigned) const             |   // (const_reference) return elem[i,j]
| + rows() const                                      |   // (unsigned) return #rows
| + columns() const                                   |   // (unsigned) return #columns
| + transposed() const                                |   // (dense_matrix) return the transposed matrix
| + data()                                            |   // (pointer) return ptr. to 1st elem
| + data() const                                      |   // (const_pointer) return cptr. to 1st elem
|-----------------------------------------------------|
```

```
|-------------------------------------------------------------|
| Helper functions:                                           |
|-------------------------------------------------------------|
| operator*(const dense_matrix&, const dense_matrix&)         |   // (dense_matrix)
| swap(dense_matrix&, dense_matrix&)                          |   // (void)
|-------------------------------------------------------------|
```

```
Implementation inside the class:
there is NOT: m_data[i,j];
instead:      m_data[sub2ind(i,j)].
Where:        sub2ind(i,j) = i*m_columns + j;
```

how is called	what is
container_type	vector<double>
value_type	double
size_type	unsigned
pointer	vector<double>*
const_pointer	const vector<double>*
reference	vector<double>&
const_reference	const vector<double>&